

FASCINE TRAINING AND PROTECTION WORKS.

IN the *Engineering Magazine* (New York) for June is an interesting illustrated article on "Bank Revetment on the Mississippi," with illustrations showing the condition of the banks of the river after "caving" and the method of making and fixing the fascine mattress work used for their protection.

The lower part of the Mississippi runs through a vast alluvial plain, the surface of which is below the level of the water in the river in times of flood. This land is protected by banks locally known as "dykes" or "levées," which prevent the flood water from inundating the district. The first of these banks was built at New Orleans in the early part of last century. They are constructed of the earth taken from surface of the ground close by, and are constantly liable to damage by floods. Some of them are of considerable dimensions, and of sufficient width at the top to form a roadway for carts and other vehicles. From time to time these banks have been extended until

long by 60 feet high, containing 80,000 feet of lumber, 2000 tons of rock, and nearly 20,000 lbs. of iron wire and rods, are placed in the water in a depth of 150 feet.

The mattresses are constructed by first building on floating ways a rigid head of poles, to which weaving poles are fastened at right angles. On these, woven willow brush is laid; a grillage of poles is then fastened to the top, and after being secured to the bank and mooring-barge, the mat, 400 feet long by 150 feet wide, is sunk by means of large stones thrown from the barges. After sinking the mat the upper portion of the bank is levelled to a regular slope by what is termed an "hydraulic grader." This machine consists of a pump having a discharging capacity of 2000 gallons a minute, fixed on a barge. The hose from this pump terminates in a $1\frac{1}{4}$ -inch nozzle, from which the water is directed on the bank at a pressure of 160 lbs. on the inch, reducing it to the required slope. By this method the excavation of one cubic yard of earth takes a fraction less than one cubic yard of water, and uses 3 lbs. of coal. The height of the bank thus graded often averages 30 feet, and the

material removed along a length of 100 feet, about 3500 cubic yards, costing about 4 cents (2d.) per yard for removal. When the bank is levelled and dressed to the required slope, a revetment of two layers of brush, with pole grillage above and below, fastened with wire and spikes, is placed thereon and then covered with stone. Another method of protection is by fascine mats made of bundles of poles 3 feet in diameter, laid normal to the bank; to these is fastened at intervals of 8 feet a $\frac{5}{16}$ -inch wire cable and $\frac{1}{4}$ -inch wire strand. Fascines 11 inches in diameter, made of bundles of willows, are then placed parallel to and against the head, and held in place by a turn of the wire, and the operation repeated until the desired size is attained. These woven mats often have dimensions of 300 by 1000 feet. To build and sink a fascine mattress 300 feet wide, requires from 250 to 300 men, and the average progress per day is about 150 lineal feet. Of the finished cost about 45 per cent. represents labour, and 55 per cent. material.

The article in the *Engineering Magazine* only deals with fascine work as applied to the maintenance and repairs of the banks of the river.

there has been developed the great levée system which extends nearly from Cairo to the Gulf of Mexico, protecting an area of about 30,000 square miles of rich land and numerous towns and villages, and guiding the floods in a permanent high-water channel to the sea.

These banks are a constant source of care and anxiety to those who have charge of them, being subject to "caving" caused by abrasion; the action of soakage water; and the undermining of the foot of the slope by the current. To prevent this caving, and for the repair of the bank, where it has taken place, brush and stone revetments are used. The material for this purpose is principally live willow or cotton wood poles from 25 to 30 feet long, and fascines fastened together in the form of mattresses by iron wire. No revetment work in the world approaches the magnitude of that undertaken on the Mississippi. Here mattresses, having a superficial area of seven or eight acres, are sunk in the bottom of the river in depths of from 80 to 100 feet, and in currents flowing at the rate of from 4 to 5 miles an hour. Dykes 430 feet

The jetties at the mouth of the Mississippi, constructed for the deepening of one of the outfalls of the river into the Gulf of Mexico, for the purposes of navigation, were constructed entirely of fascine mattresses. In order to improve the depth from the gulf into this magnificent river, which has a navigable water-way extending over 16,000 miles, Captain Ends advised the training of one of the principal outlets, and so by confining the water within defined limits, and increasing its velocity and scouring power, to obtain greater depth. He undertook to carry out the necessary works to effect this purpose without receiving payment unless he succeeded in obtaining a channel 200 feet wide with an average depth of 26 feet, and a central depth of 30 feet. This he successfully accomplished. The east jetty is rather over two miles in length, the other being a little shorter; the effective width between them is 700 feet. The mattresses used in the construction of the jetties were made principally of willows brought from the swamps over distances varying from 20 to 300 miles;

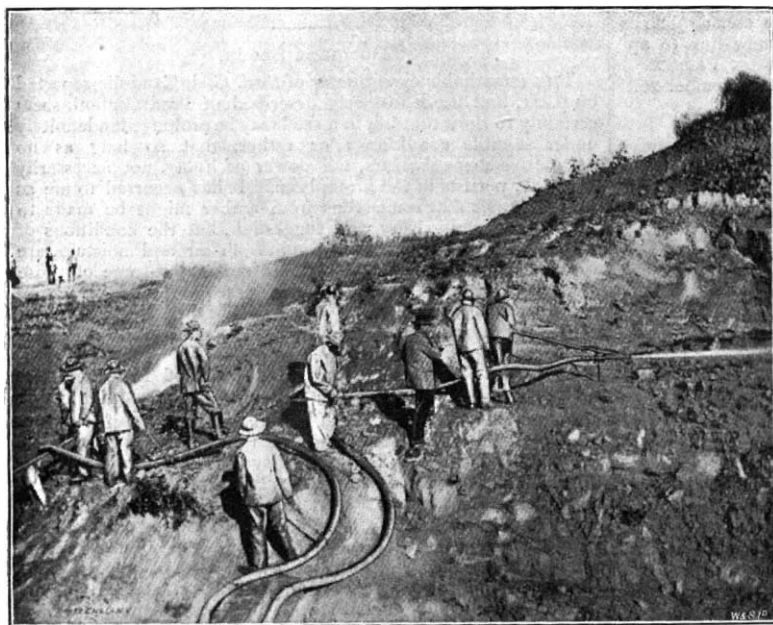


FIG. 1.—Details of Hydraulic Grading.

these were weighted with stone brought down the Ohio River from a distance of 1320 miles, the quantity used amounting to 100,000 cubic yards. The mattresses used were about 100 feet long, and from 40 to 50 feet wide. They were built on inclined ways at the head of the Pass, and when completed launched like a boat and towed floating to their place along the line of the jetty, and then loaded with stone and sunk. The same method of training the outfall of the river has been adopted on other parts of the coasts of the Gulf of Mexico and of the United States.

The jetties at the mouth of the river Maas, in Holland, were also constructed of fascine mattresses in a somewhat similar way. These piers are about one and a half miles in length, and terminate in a depth of twenty-two feet at low water. Experience shows that their elasticity saves them from any damage from the shocks caused by the impact of the waves. They were economical in construction, and have been found after twenty years' experience to stand the wear and tear of the waves of the North Sea. The great dam across the Zuyder Zee at Schellingwoude, in connection with the North Sea Canal, was also constructed with fascine mattresses on the exterior, the centre part being filled in with earth.

Owing to the scarcity of material for making the fascines, this system of mattresses has not been employed in this country. But more than half a century ago fascine training walls were largely adopted for the improvement of the four large Fen rivers emptying into the Wash, and this system is still in use. They have answered their purpose admirably. The fascines are made of thorn faggots about three feet in girth, tied together by tarred rope. These faggots are brought to the spot where the training wall is being constructed in barges, and placed in layers, the number of faggots in width depending on the height the wall is to be carried. Each layer is covered with clay or marsh sods, and the side next the river finished to a slope of about six inches horizontal to one foot vertical, the brush ends being placed outwards and trimmed up. Sometimes the faggots are staked down, but this, as a rule, is not found to be necessary. This method of training has by experience been found to be economical, durable, and efficient; and has this great advantage over stone training walls, that vessels which by accident run on to the walls are not damaged in the way they are when they come in contact with the stone.

A full description of this work, and also of the mattresses used in Holland and America, with illustrations, will be found in the chapter on "Training," in the work on "Tidal Rivers," added a short time ago to Longmans' Engineering Series.

SIR WILLIAM MACGREGOR'S RECENT JOURNEY ACROSS NEW GUINEA, AND RE-ASCENT OF MOUNT VICTORIA.¹

BY the courtesy of the Prime Minister of Queensland, Sir Hugh M. Nelson, I have been favoured with the following copy of a telegram from His Excellency the Administrator of British New Guinea to His Excellency the Governor of Queensland:—

"Without loss of life or limb have crossed New Guinea

¹ Read at a special meeting of the Royal Geographical Society of Australasia, Brisbane, October 30, 1896.

from mouth of Mambare to mouth of Vanapa. Followed Mambare to foot of Mount Scratchley where river divides to embrace the mountain. Ascended Mount Scratchley, on top of which observed with small theodolite. Found easy road west of Stanley Range, without descending re-ascended Mount Victoria to observe, but weather unfavourable. Descended Mount Knutsford, and found a not difficult road to coast. The miners have been at work at foot of Scratchley, probably the whole of which is auriferous. Wharton Chain connects Mount Scratchley with the great Mount Albert Edward, which is also well inside British territory. All these great mountains seem composed of slate and quartz. No natives between Government Station and Mount Scratchley. On the latter is very friendly tribe. Excellent relations with natives from Mount Knutsford to the coast. Had scarcely a single completely dry day. I strongly dissuade any travelling towards the interior before April or May. Native carriers will not be permitted to proceed inland with Government sanction before then, when all possible



FIG. 2.—Constructing Fascine Mat on Mattress Ways

facilities will be given to prospectors during the dry season. (Signed) "WM. MACGREGOR."

It is well known that in 1889 Sir Wm. MacGregor, who at that time had but very limited resources at his command, successfully accomplished the ascent of the Owen Stanley Range to its highest summit, which he named Mount Victoria.

In the course of my official duties, the work of compiling the map illustrating the explorer's route on that occasion devolved upon myself, and I am consequently morally responsible for the correct delineation of all the features upon it, although this does not appear on the face of the map itself. At the same time I had the privilege of being the first to deal with, examine, and make public the geographical results of that famous journey, in a paper read, in Sir Wm. MacGregor's presence, at a meeting of the Royal Geographical Society of Australasia, Brisbane, on September 2, 1889. I mention this to show that I have an intimate knowledge of every detail connected with the work and results